

# **The Impact of a Guideline-Driven Computer Charting System on the Emergency Care of Patients with Acute Low Back Pain**

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*Federal guidelines for the treatment of acute low back pain were locally modified and made more specific. These guidelines were then programmed into a rule-based computer charting system which provides real-time advice regarding documentation, testing, treatment, and disposition of emergency department patients with this condition. In a time-series off-on experiment the system was shown to significantly improve documentation of the medical record and discharge instructions. There was little effect on the appropriateness of testing and treatment and the cost of care. These findings contrast with our previous experiment using a similar program for the care of health care workers exposed to body fluids. In that study both the appropriateness of care and the cost-effectiveness of care were substantially improved.*

## **INTRODUCTION**

There has been increasing interest in the development of clinical guidelines over the past decade and the number of extant guidelines has increased exponentially. Unfortunately, less thought has been given to methods for successfully implementing them. Computer-based interventions have been shown to improve the quality of ambulatory care. Systems that can provide protocol-based reminders or access to computerized medical records are useful, provided that the physician actually uses them.<sup>1,2</sup> We have been developing an emergency department expert charting system (EDECS) that exposes physicians to clinical guidelines within the context of routine patient care.<sup>3</sup>

The fundamental principle of our system is that if guidelines are to have impact, they must be integrated into functions which physicians find useful in the routine care of patients. For this reason EDECS' primary role is the creation of all of the paperwork

required in emergency care. It produces all laboratory and treatment orders as well as the medical record, patient after care instructions, and prescriptions. The physician who uses EDECS only puts pen to paper when he needs to sign his name. The guidelines operate automatically in the background. The user is unaware that they are there until advice is provided in the form of suggestion windows or order screens which are color-coded to indicate the appropriateness or inappropriateness of each option.

Our experience with this system for the treatment of health care workers exposed to body fluids ("needlesticks") has been previously presented.<sup>4,5</sup> The use of EDECS resulted in dramatic improvements in the quality of documentation, the appropriateness of testing and treatment, and the quality of the after care instructions. This improvement in quality was accompanied by a 23% decrease in cost (charges). To test whether these effects are generalizable beyond this complaint, the next EDECS module was designed to treat patients with acute low back pain.

Acute low back pain is one of the most common problems encountered in the Emergency Department.<sup>6</sup> Such complaints accounted for 3.3% of annual visits to our institution's ED. The morbidity and expense of these back pain symptoms have been well documented, and the Agency for Health Care Policy and Research (AHCPR) has published a comprehensive guideline for the management of this problem.<sup>6</sup> Simply publishing a guideline, however, does not insure that improvements in practice will follow.<sup>7,8</sup>

We hypothesized that the availability of EDECS for the management of patients with acute low back pain would result in many of the aforementioned benefits gained from the use of the "needlestick" module.

## METHODS

### Guideline Development

The AHCPR guideline was used as a starting point for the local guideline development effort. Because this guideline was insufficiently detailed to permit direct programming of EDECS, we used Eddy's explicit method to make the needed refinements.<sup>9</sup> This was supplemented by the opinion of local experts. Our guideline specifies the content of the core history and physical required on all low back pain patients, additional H & P required on specific patients, indications (and non-indications) for tests and treatments, disposition rules, and the content of the after care instructions.

### EDECS Software and Hardware

Programming was performed in the OS-2 based expert system shell AM<sup>TM</sup> (Intelligent Environments, Tewksbury, MA). The software consists of separate subroutines (dynamically-loaded modules [DLMs]) for the different program activities (e.g., history of present illness, physical examination, ordering labs, creating the discharge instructions, etc.) which are linked by a main module which contains the rules. All rules are run each time the program completes a module. The guideline-based rules are mostly of the "if...then" variety, with limited use of more complicated weighting structures. The program is currently run on a stand-alone PC in the central work area of the emergency department. In the future, this will be linked via LAN to a comprehensive patient care system being developed for our department.

### The EDECS Intervention

The physician, aided by a list of "essential" items required by the computer, interviews and examines the patient. She then leaves the patient and, primarily using a mouse, enters patient data into the computer. Essential items are colored red on the screen and must be addressed. An "unknown" choice is always provided to ensure that physicians are not forced into making untruthful statements. Using the guideline rules, EDECS identifies any additional information that should be obtained. EDECS then analyzes the complete database and suggests appropriate tests and treatments. The computer's recommendations regarding testing and treatment are also conveyed using color (red=strongly suggested, green=optional, grey=discouraged). The results of any tests are entered, and EDECS suggests diagnosis, disposition, and follow up. All laboratory and treatment orders, prescriptions, medical records, and discharge instructions are printed by EDECS. The program always permits physicians to

deviate from recommendations and provides them a mechanism for documenting their rationale for the deviation.

### Experiment Design and Data

We used a prospective, time-series comparison of control and test periods to examine the effect of EDECS on the care of acute low back pain patients. The control period ran from May 1992 through November 1992. During this time charting was done by hand. The medical records of adults with acute low back pain were identified from the ED patient log, and data for those patients meeting inclusion criteria were manually abstracted.

Patients were eligible for the study if they were at least 16 years of age and low back pain was their primary complaint. They were excluded if they had continuous pain for more than 3 months, back surgery in the past two years, known systemic disease causing their back pain, or were believed by the intake nurse to be having renal colic.

The test period ran from May 1993 through December 1993. During the test period EDECS was available, although physicians could chart by hand if they desired. Each physician received a thirty minute orientation to EDECS and was informed that their use of this system was encouraged but entirely optional. Patients with acute low back pain were identified by the intake nurse. Patient data were saved electronically when EDECS was used; data from the handwritten charts during the test period were manually abstracted. For both periods, cost (charge) data were downloaded from the hospital mainframe.

## RESULTS

### Subjects

During the control period, 206 patients met inclusion criteria and were, by definition, treated without EDECS. Of these, a random sample of 103 charts was analyzed. During the test period, 259 patients met the inclusion criteria. Of these, 202 were treated using EDECS (79%). All 259 charts were included in this intent-to-treat analysis of the test period.

### Documentation

Each chart was analyzed to determine whether items specified in the guideline as essential or desirable were documented. Selected results are summarized in Table 1.

**Table 1. Percent of Charts with Documentation of Essential Items**

Essential Items	Control Period	Test Period
Cause*	86%	98%
Radiation*	36%	87%
Weakness*	50%	87%
Gait/strength exam*	57%	90%
Sensory exam*	49%	80%
Straight leg raise exam*	78%	95%

All  $p < .001$  by Chi-square analysis.

\* = required in all patients

♣ = required in select patients

#### Appropriateness of Care

EDECS provides guideline-based advice to the physician regarding whether or not lumbar spine radiographs, urinalysis, and other blood tests should be ordered. It also gives advice regarding outpatient therapy for pain control. Results are presented in Table 2.

**Table 2. Use and Appropriateness of Plain Radiographs of the Lumbar Spine and Selected Outpatient Medications**

Criterion	Control Period	Test Period
X-ray ordered?	61%	58%
•Decision appropriate?	74%	75%
Acetaminophen, ASA or NSAID given?	83%	79%
ASA or NSAID given?	71%	34%
•Contraindication denied?*	4%	58%
Muscle relaxant given?	39%	36%
•Duration documented*	17%	82%
Narcotic given?†	41%	30%
•Duration documented*	3%	77%

\*  $p < .001$  by Chi-square analysis.

†  $p = .06$  by Chi-square analysis, others NS.

#### Documentation of Discharge Instructions

Our practice guideline identified specific items that should be included in the after care instructions for patients with acute low back pain. Representative items are presented in Table 3.

**Table 3. Percent of Charts Containing Desired Aftercare Instruction Items**

Aftercare Items	Control Period	Test Period
Given routine follow-up?	60%	93%
Not given > 3 days of bed rest	83%	99%
Exercise encouraged	8%	78%
Told what activities to avoid?	22%	97%
Given dose/schedule of any medications?	52%	92%
Given other instructions regarding medications?	21%	83%

All  $p < .001$  by Chi-square analysis.

#### Cost of Care

A comparison of cost data between study periods is provided in Table 4.

**Table 4. Median Charges, in Dollars, by Charge Type.**

Charge Type	Control Period	Test Period	Change* in Cost
Radiology	145	164	+19
Laboratory	12	16	+4
Facility & Physician	224	214	-10
Total Median Charges	411	439	+28
Total Mean Charges	239	257	+18

\* all  $p$  values not significant by Wilcoxon rank-sum test

## DISCUSSION

The second EDECS module again demonstrated our physicians' willingness to use EDECS as an expert charting system. This finding must be tempered by the knowledge that these are primarily housestaff at a training institution and that similar acceptance in the community cannot be assumed.

Documentation of the medical record markedly improved when EDECS was used. This is not very surprising, since EDECS requires input of critical patient information before the user can continue through the program. Although simple, this method of capturing the right patient data has important implications for quality assurance and clinical research. Traditional chart review for quality assessment or research purposes is often stymied as charts are too poorly documented to permit assessment of the appropriateness of the care. Moreover, such review does little for these patients after the fact. With EDECS, however, comprehensive information gathering is accomplished while the patient is still in the department, increasing the likelihood of appropriate care.

According to the guideline, for example, it is desirable that every patient with back pain who is a candidate for ASA or NSAID therapy be assessed for contraindications to these agents. In the control period this activity was documented in only 4% of the eligible cases. During the test period, 58% of eligible charts addressed this issue. Using EDECS, uncommon but potentially devastating drug side effects can more often be identified and avoided.

After care instructions were far more complete when generated using EDECS. Our system provided back pain patients with information that explained their condition, what follow-up they needed to receive, what medicines they were to take, what activities to pursue, etc. These were written in ordinary language and were available in either English or Spanish. In contrast to the "canned" computer-generated discharge instructions that are commonly used in Emergency Departments and are generally the same for all patients with a condition, our instructions are automatically tailored to the individual patient.

The use of EDECS to manage patients with low back pain did not result in significant differences in the appropriateness of testing or the cost-effectiveness of care. This is in contrast with our experience with the "needlestick" module where both of these were

substantially improved. We believe that the failure to improve the appropriateness of testing is reflective of the general confusion regarding the utility of plain x-rays in patients with low back pain. No existing decision rule offers great specificity while maintaining a high sensitivity, and our doctors often deviated from the computer's recommendations. This may not necessarily reflect sub-optimal care, since the performance of the decision rule used in the computer has not been fully validated.

Similarly, the lack of clarity regarding the appropriateness of radiographs and other laboratory tests in the evaluation of back pain results in guideline recommendations that are non-specific. Therefore, EDECS presents more tests to the physician as "optional," and less cost-containment is observed. It is likely that future EDECS modules will have variable effects on costs. Each module's effect will be determined by the current state of practice and the presence or absence of a strong set of valid rules capable of decreasing inappropriate utilization.

This module did have positive effects on the appropriateness of treatment. Whereas the old teaching was to instruct back pain patients to "go to bed," current guidelines stress the importance of early activity and the dangers of anything more than a few days of bed rest. EDECS was able to significantly decrease the number of patients who were told to stay in bed for more than three days.

In summary, this EDECS module had beneficial effects on the quality of care, but had little effect on cost. We are currently evaluating other modules which aid physicians in caring for epileptics with seizures, febrile children, and males with discharge or dysuria.

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